and we should be sorry to suggest that scientific investigators themselves should seek to get into the limelight or take part in the turmoil of politics. They are much better employed in the laboratory than in Parliament. What are wanted, however, are advocates of science and scientific method—men and women who know the disinterested spirit in which purely scientific inquiries are carried on and desire to introduce into social and political discussions the same impartial attitude towards evidence and fearless judgment upon it. At the present time it is in a large measure the mission of science to rebuild a shattered civilisation, not alone by providing the foundations for material progress, but also by introducing scientific methods and the scientific spirit into all fields where questions of national significance are debated.

To attain these ends there must be a much wider understanding of the service of science than exists at present. Science will not advertise itself, but there is every reason why believers in it should undertake a publicity campaign on its behalf. Dozens of interesting leaflets or short pamphlets might be written showing what science means to progressive industry and modern civilisation, and they should be distributed in thousands both to enlighten and to stimulate. Wireless telephony, for example, is a direct product of purely scientific studies. The tungsten used for the filaments in the thermionic valve and in metallic filament lamps generally, was discovered more than a century ago. It enters into the constitution of all high-speed tool steels and every magneto. Manganese, nickel, titanium, aluminium, and other essential constituents of the alloy steels now used for many engineering purposes were all first discovered in scientific laboratories. So also were the thorium and cerium used in the manufacture of incandescent gas mantles, calcium carbide for the production of acetylene gas, the methods of extracting nitrogen from the air to produce nitrates for explosives and agricultural fertilisers, and hundreds of other substances and processes which are now accepted as part of our daily life without a thought of their origin.

The most remarkable of such developments is that of helium gas discovered by Sir Norman Lockyer in the sun in 1868, found in terrestrial minerals by Sir William Ramsay twenty-six years later, and now being produced in millions of cubic feet from certain oil wells in the United States, where all airships are compelled to use this gas instead of hydrogen. It is quite possible that the practical monopoly of helium which America possesses in its rich sources of supply, may be of great significance both in the arts of peace as well as those of war. At any rate, the United States Government is quietly accumulating vast quantities of the gas compressed in cylinders for whatever needs the future may bring.

It is obvious that valuable national and Imperial service can be performed by a body which has sufficient funds to undertake active propaganda work for the extension of an understanding of the influence of scientific research and its results. The only organisation which is attempting to do this is the British Science Guild, founded in 1905 to convince the people, by means of publications and meetings, of the necessity of applying the methods of science to all branches of human endeavour and thus to further the progress and increase the welfare of the Empire. The Guild is thus not a scientific or technical society but a body of citizens united for the purpose of making the Empire strong and secure through science and the application of scientific method. Its relation to the work done in our laboratories is that of the Navy League to the Royal Navy—to watch and promote progress. Lord Askwith has just accepted the presidency of the Guild in succession to the Marquess of Crewe, who has reluctantly had to withdraw from this office on account of his appointment as British Ambassador at Paris.

Active steps are shortly to be taken by the Guild to secure adequate funds for displaying the fertility of British science not only throughout the Empire but also to the whole world. We possess a great treasure, and in these days cannot afford to let it lie hidden. It is devoutly to be hoped, therefore, that when the British Science Guild makes its appeal for funds and members there will be a rich and ready response to it, so that branches may be established throughout the Empire for the strengthening of the foundations of the knowledge upon which our position among the nations of the world depends. The British Empire Exhibition to be held in 1924 will provide an opportunity for showing what science has accomplished, and we look to a body like the British Science Guild to see that the promoters provide in the Exhibition a Temple of Science which shall be worthy of the great achievements of British genius.

Wegener's Drifting Continents.

Die Entstehung der Kontinente und Ozeane. By Dr. Alfred Wegener. Dritte gänzlich umgearbeitete Auflage. Pp. viii + 144. (Braunschweig: Friedr. Vieweg und Sohn, Akt.-Ges., 1922.) 9*s*.

HOWEVER much conservative instincts may rebel, geologists cannot refuse a hearing to Dr. Alfred Wegener, professor of meteorology in the University of Hamburg. As an oceanographer, he looks out over the boundaries of sea and land; as a meteorologist, he is interested in changes of climate in the past. Like many scientific workers, he feels that a recognition of the Permo-Carboniferous ice-age compels him to put forward an explanation. Like them, he overlooks the fact that a century of speculation as to the causes of the glacial epoch of far more recent times has left us with a score of hypotheses amid which we wander unconvinced. The evidence of the occurrence of ice-ages becomes more and more cogent as observation spreads, and it is highly probable that they have a common cause. Prof. Wegener, in laying stress on the differences between equatorial and polar temperatures at the present day, takes up the position of greatest difficulty, and regards a regional refrigeration as necessarily connected with the poles. He does not look beyond our planet and the atmospheric conditions that now prevail. It is evident that Prof. Spitaler's laborious inquiries as to zonal fluctuations will not content him, though this author believes that he has drawn the Permo-Carboniferous glaciation into his uniformitarian net. Wegener's suggestions are far more heroic; he will shatter the outermost layer of the crust to bits, and remould it, by successive arrangements of the pieces, nearer to his heart's desire. His theme is fascinating, and his style is admirably lucid. His fondness for "hüben und drüben," a phrase, we believe, derived from Goethe, makes us wonder if he treats the globe as lightly as it was treated in the "Hexenküche." For him indeed "sie klingt wie Glas; sie ist von Ton, es giebt Scherben."

As is well known, Wegener has been much impressed by the easterly salient of S. America and the easterly indent of the African coast. If we could assure ourselves that these were at one time, and at the right time, actually in contact, most of the problems of oceanic islands, of palæoclimatology, and of the distribution of land-organisms, would be solved. Would not the instability of S. America in regard to Africa imply a similar instability between N. America and Europe, of which there is (p. 81) some geodetical evidence, accepted by Wegener, but much open to discussion? If the Atlantic is a crustal rift, the other oceans are likely to have had a similar origin. The primary crust, the silica-alumina layer, which Wegener calls *sial* in preference to Suess's less distinctive word *sal*, broke open and gave rise to continental blocks and accessory islands, which float, and even waltz, upon the *sima*, the silica-magnesia layer that underlies them.

There is a concluding figure in many Bantu dances—it survives even in folk-dances at Skansen—where two partners turn back to back, bump, and part again. The possibility of this figure on a continental scale is thrilling and attractive. If Africa once parted from America, she may woo her mate again as years pass by. The hand of the philosopher may be laid on the great land-blocks, and the occurrence of Glossopteris in India or of *Geomalacus maculosus* in Kerry may be explained by a simple process of "Verschiebung." If the fitting is not sufficiently accurate, some plasticity is granted to the sial blocks, and "Umwälzung" is also possible (pp. 35 and 41).

Wegener's conception, however, must not be taken in the spirit of a jest. Experiments on the force of gravity, made over very wide areas, have established the existence of a mass-defect under mountain-ranges and a mass-excess under lower grounds and oceans, and the sea-floor may be justly regarded as consisting of sima in large degree. It has long been recognised that a crumpled crustal mass bulges both upward and downward; it displaces what we now call sima in the depths. On the theory of isostasy, it maintains its elevation above the general surface by the fact that it displaces matter the specific gravity of which is greater than its own. Like ice in water, it floats, with a certain portion unsubmerged.

The analogy with ice is seized on by Prof. Wegener. If icebergs shift their places and "calve" by cracking on their flanks, why should not continents do the same? Let us grant that the level of the sima is reached at a less depth than that of the ocean-floors; the latter must then be composed of sima, and over them the buoyant continents may meet, and waltz, and part again. Of course they may do so; but when we are asked (p. 101) to look for the sima level about 100 fathoms down, or in some rare and dubious cases at 250 fathoms, we find that the rocks familiar to us on the land-surface are held to extend very little beyond the ordinary continental shelves. The chalk and flints dredged from 600 fathoms off western Ireland will require a new explanation. In depth, the continental blocks may go down to 100 km. Their relations to the earth as a whole, on this supposition, are shown on the same longitudinal and vertical scale in an expressive section following a great circle between S. America and Africa. The two continents are seen to be well immersed in sima. Sima (p. 113) behaves under pressure like sealing-wax, and sial like wax. Hence crumpling occurs in the sial blocks when they are pressed against the sima, though the latter in time yields and flows. Higher temperature in the depths assists this flow, and (p. 105) inclusions of sima in the base of sial blocks assist, by their greater fluidity, the yielding of the sial under folding thrusts.

We have now before us Wegener's view of the possibility of great horizontal displacements of the continents. The author points out (p. 6) that H. Wettstein in 1880 regarded the continents as subject to a westward drift; but he viewed the oceanic areas as representing sunken land. This widely accepted notion is rejected by Wegener at the outset.

We may ask why the skin of a contracting globe became too small for the interior, and split along rifts which ultimately widened into oceans. The answer is that our globe is not contracting. It may even be expanding through rise of temperature, and Joly's conclusions are quoted as to the influence of radium in the crust. Wegener thinks that Pickering, when, in 1907, he fitted Africa and S. America together in a retrospect, was wrong in assigning an Archæan age to the great rent. The present separation (p. 7) must have occurred since Cretaceous times, if we are to account for the similarity of structural features in the two continents. That is to say, if we reject the notion that the ocean-floors represent subsided land, and if we find similar successions of strata, and ranges with similar orientations, in two separated continental blocks, these blocks must have drifted apart. We should observe the importance of that first " if "; if we agree with Wegener's hypothesis of the inadequacy of vertical movements of the crust, we are in a fair way towards salvation. " Die Theorie der Kontinentalverschiebungen vermeidet alle diese Schwierigkeiten." Even if contraction is going on below, horizontal contraction of the continental surfaces, by "Zusammenschiebung" and consequent crumpling, goes on faster (p. 11), and this causes a rending of the sial. To Wegener this does not seem to open up a new series of " Schwierigkeiten." It explains so much that it seems to require little explanation. Yet is not this a return to the conception of a Great First Cause? Accept that, and all thereafter will run smoothly.

Here again we may be charged with speaking lightly. Wegener is dealing with possible natural events. Build up an earth on certain lines, endow its parts with certain properties, some of which are suggested by well substantiated experimental work, and certain results are rendered probable.

The great length of geological time can always be appealed to as a factor. We may now ask what causes continental lands to drift and waltz. We learn (p. 132) that there is a tendency for the blocks to move towards the equator, like other bodies capable of sliding over the main curved surface of an oblate and rotating earth, and that a westward drift may also be expected. The island-loops, the garlands, are detached portions left behind; oceanic islands, however much they may be disguised by igneous upwellings, however much they may resemble volcanic cones built up from the depths, are similar fragments stranded on the sima, children that could not keep pace with their parents in the movements of the continental dance.

This is perhaps the boldest stroke of all; but the suggestion is continued on a larger and more serious scale. New Zealand is bereft of a relative that has hurried forward as Australia, Ceylon is cast off from the foot of India, Madagascar from the African flank. Prof. Wegener reads widely, and he uses biological and geological details that suggest analogies and former continuities. He quotes even (p. 40) Lange Koch's recent tracing of the Caledonian folding into Greenland (see NATURE, vol. 110, p. 91), though he fails to recognise the significance of Sigillaria in S. Africa or of Glossopteris in northern Russia (p. 68). Having rejected the probability of land-bridges and sunken regions, the floor of the Indian Ocean becomes for him a sheet of sima, left bare by separation of the continents, and we need no longer look wistfully for the lost forests of Gondwana Land, as the flying fish come on board to tell us of the secrets of the seas.

The trough-valleys that have been traced from Suez to the Shire River, though their origin is still under discussion, are regarded as signs of a rift that threatens Africa. In Fig. 36, p. 117, we have the author's view of what may occur under such a trough; since the walls are separating, room is allowed for a sinking down of fragments from them, while sima is rising under them from below. It is obvious that a melting off of the base of subsiding portions in the sima, such as the author elsewhere contemplates, would allow of a very different representation, and that Wegener's drawing is inspired by his rejection of vertical movements in the sial. Even fjords, despite their barriers of continuous rock, are for him cracks widening by lateral movement as an ice-load presses on the coast.

Wegener's strong case against general movements of subsidence and evatelion lies of course in his discovery (pp. 19-21) that the great majority of ocean-depths lies near 4700 m. below, and of land-heights near 100 m. above, the level of the sea. Attention was directed to this by the reviewer in NATURE (vol. 109, p. 202) of the second edition of Wegener's work. The conception of flotation is thus strongly supported; but it is already part of the doctrine of isostasy. Geological difficulties in Wegener's hypothesis are discussed by Philip Lake in his review of the second edition in the *Geological Magazine* for August 1922. Literature accumulates on the subject, and we have to consider such general papers as those of Harold Jeffreys " On certain geological effects of the cooling of the earth " (Proc. R. Soc., vol. 100, Sect. A, p. 122, 1921), where account is taken of the fracturing of a primitive crust, and such local studies as those of H. A. Brouwer on the garland-isles of the Dutch East Indies (Journ. Washington Acad. Sci., vol. 12, p. 172, 1922). Brouwer regards the garlands as the crests of growing anticlines, based on crumpling masses that have a considerable lateral as well as vertical movement. Meanwhile, Wegener, flinging down his gage, certainly calls on us to justify such faiths as we at present hold. His principal geographic rearrangements are shown in a series of small maps, in one of which the northern lands are rearranged so as to explain the latest glacial epoch. The Permo-Carboniferous glaciation presents difficulties, as was pointed out in a notice of the excellent papers by Du Toit (NATURE, vol. 109, p. 757); but Wegener, when he has clustered his land-masses around the pole, shifts the pole from point to point among them, to suit their special idiosyncrasies. Nothing daunts so bold a champion. The hand of the master presses on the sial blocks or on the polar axis, and all goes well with the hypothesis.

Has the author considered, however, that no re-groupings of the furniture of the earth will account for the simultaneous reduction of ice-masses in all glaciated regions at the present day? Can, moreover, the evidence for general rises of temperature in the past be so lightly set aside? Can—but these questions are endless; those who still hope for simple explanations may well turn their eyes for light and inspiration, with Akhenaten, to the sun.

GRENVILLE A. J. COLE.

A New Treatise on Chemistry.

A Comprehensive Treatise on Inorganic and Theoretical Chemistry. By Dr. J. W. Mellor. Vol. 1. Pp. xvi + 1065. Vol. 2. Pp. viii + 894. (London: Longmans, Green and Co., 1922.) *3l. 3s.* net each vol.

THE writing of a "Comprehensive Treatise on Inorganic Chemistry" presents a problem which becomes more and more difficult with each successive year. The small text-books of a century ago soon required to be expanded into a series of volumes such as were issued by Watts in 1868, and in the English translation of Gmelin, of which 19 volumes were issued between 1848 and 1872. In recent years the growth of the subject has been so rapid that nearly all the more recent successes have been scored by teams of workers, such as those who have collaborated in the production of Thorpe's "Dictionary of Applied Chemistry" in England, and of Moissan's "Traité de chimie minérale" in France, as well as in the more recent German productions. Even so, as Dr. Mellor reminds us in his preface, the seventh edition of Gmelin, begun in 1905, is not yet completed, while three other unfinished compilations date back to 1905, 1900, and 1874 respectively. For every reason it is greatly to be hoped that Dr. Mellor will be able to carry through to completion the series of volumes of which the first two have now been issued.

In reviewing these two volumes (and perhaps paying more attention to the first than to the second), it is necessary in the first place to offer respectful homage to the author for the vast range of accurate information which he has gathered together. Almost every item of fact appears to have been abstracted from the original sources, and by a system which has left very little room for casual errors. It is, moreover, remarkable to find that an author, whose interests have generally been thought to centre themselves in the mathematical and physical aspects of chemistry, should be in a position also to deal in such an able manner with other topics, such as the early history of the science, which occupies a substantial portion of the first volume. In these chapters his references are often more numerous and earlier than those which are given in the more formal histories; thus, included in volume 1 are a number of unexpected references to the history of combustion before Jean Rey, of oxygen before Priestley, and of crystallography before Haüy, while volume 2 contains, on page 419, an amazing quotation from Roger Bacon, from which it might perhaps be supposed that metallic sodium had already been prepared in the thirteenth century! If the historical portion of the volume is dull reading, the major portion of the blame must be ascribed to the infertile character of the science during two of the three periods into which its history is divided by the author, namely, the first or mythological period, and the second or philosophical period, before it finally reached in the seventeenth century the third or scientific era. Certainly the 50 pages which are devoted to these preliminary stages fully justify the policy which has been adopted generally by teachers, even of historical chemistry, of curtailing within the narrowest limits the study of everything prior to about 1600 A.D. A lingering doubt as to whether this early period is quite so dull as it appears has, however, been raised in the mind of the reviewer by the sudden arousal of his interest when, on page 107, a series of quotations are given from a translation of Lucretius instead of a mere second-hand summary of his views on atoms.

The materials for the Treatise have already been used in part in the author's "Modern Inorganic Chemistry"; conversely, the treatise bears evidence that it has been based, in part at least, upon an expansion of the text-book. This hypothesis at any rate serves to account for some features in the arrangement of the treatise which are awkward and perhaps undesirable. Thus, in a text-book, which the student is expected to read consecutively from cover to cover, and in which the assumption is made that the reader